# *Reviews*

*The Okanagan Composite Batholith of the Cascade Mountain System.* By REGINALD A. DALY. (Bulletin of the Geological Society of America, Vol. XVII, pp. 329–76, 1906.)

This batholith is on the international boundary between British Columbia and the state of Washington. Its east-west dimension is about sixty miles; the north and south limits are not known. The batholith is composite, the individual intrusions having been made from late Paleozoic to late Tertiary time. There is considerable variation petrographically in these intrusions, the later ones being as a whole progressively more acid, but the series was broken near the close of the Laramie by the intrusion of some alkaline syenites and malignite. The small Paleozoic bodies are a complex, variable, highly metamorphosed series of gabbros, peridotites and dunite. The Jurassic batholiths are of granodiorite, and the Tertiary batholiths are of biotite-hornblende-granite and biotite-granite. There are a few dikes of olivine basalt, thought to be of Pleistocene age.

It is evident from Daly's descriptions that these rocks are in general accord with the rest of the Pacific Coast petrographic province in their moderately high ratio of soda to potash.

In Lower Cretaceous time the Jurassic granodiorites had been exposed by erosion, and over 30,000 feet of arkose sandstones, grits, and conglomerates were deposited on them. This was followed by deformation, which resulted in the production of faults and folds in the Cretaceous strata, with dips averaging over 45°. Probably at the same time the granodiorites were sheared and crushed into banded gneisses and gneissic granites.

The method of batholitic intrusion by replacement is discussed, and an ideal skeleton history of a batholite is given.

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*Crescentic Gouges on Glaciated Surfaces.* By G. K. GILBERT. (Bulletin of the Geological Society of America, Vol. XVII, pp. 303–16; Pls. 37–39. 1906.)

The chatter-mark and crescentic crack are described. The former is thought to be due to the slow, rhythmic striking of bowlders embedded in the basal ice. Fracture results, if the surface of the rock is under tension.

Crescentic cracks which are vertical and, like chatter-marks, are concave forward, may be explained as the result of the difference in stress parallel to the rock-face, arising from differential friction.

Crescentic gouges are convex forward (downstream). Those here described measure from a few inches to over six feet across. The gouges generally occur in sets, the members of a set being usually of nearly equal size. They occur on both bottoms and walls of glacial troughs. Crescentic gouges consist of two elements: a gently sloping, incomplete, conoid fracture, on the upstream side; and a subsequent, vertical, crescentic fracture, that forms the downstream side of the gouge. The "conoid" fracture is due to shear from an inclined pressure arising from the downward and forward pressures of the ice, as modified by differential friction. This inclined pressure is thought to have been applied by bowlders acting through a thin cushion of débris or of débris-loaded ice, at places where the ice rose over obstructions. The thin wedge formed by this fracture was broken across vertically, and the crescentic wall produced. This second break is due to stress from the upturning of the edge of the wedge when the formation of the first crack relieved it of compression, and the resistance of the ice pressure against this upturning.

The author regards the gouges as the result of "a mechanical rhythm of some sort," and suggests that the constant pressure of the ice may induce a group of mechanical rhythms to accumulate stress and strain within the rock, until the breaking-point is reached and a conoid fracture produced.

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*Geological Reconnaissance of the Coast of the Olympic Peninsula, Washington.* By RALPH ARNOLD. (Bulletin of the Geological Society of America, Vol. XVII, pp. 451–68; Pls. 55–58.)

This paper gives the preliminary results of the first measurement and study of any comprehensive Tertiary section in the Pacific Northwest.

The topography of the Peninsula is not very well known. Its dominant feature is the Olympic Mountains, a rugged alpine group rising to a maximum elevation of 8,200 feet, and having a local relief of about 7,000 feet. There are no railroads, wagon roads, or trails in the higher mountains, and considerable areas are almost impassable even to a man afoot.

Surrounding the higher mountains, especially on the northwest, west, and south sides is a maturely dissected plain, sloping seaward from elevations of 4,500 to 5,000 feet. The streams crossing this plain, in fact all the streams of the Peninsula, flow nearly straight outward from the central